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WESTERN WHITE PINE CONES POLLINATED WITH 1- TO 3-YEAR-OLD POLLENS GIVE GOOD SEED YIELDS

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ABSTRACT

Filled seed yields of Pinus monticola cones from 55 controlled crosses made with 1- to 5-year-old, deep-freeze-stored pollens were compared with yields from other fresh-pollen crosses made on the same trees in the same pollination seasons. Observations covered four pollination seasons, and on the average involved about 11 trees, and 14 stored-pollen and 25 fresh-pollen crosses thereon, per season. One- to 3-year-old pollens gave 52 to 110 percent of the yield observed for fresh pollens, and there was some evidence that 4- and 5-year-old pollens might also be satisfactory for routine use.

In the course of 18 years' work toward breeding varieties of western white pine resistant to attack by the blister rust fungus (Pinus monticola Dougl. resistant to attack by Cronartium ribicola J. C. Fisch. ex Rabenh.), we have attempted several thousand controlled intraspecies crosses. Whenever possible, freshly extracted pollens have been obtained for this work. Occasionally, however, we have encountered trees lacking sufficient pollen during the season they were scheduled for use as pollen parents. More frequently--even with greenhouse "forcing" of pollen-bearing branches--we have been unable to secure pollens from phenologically late trees (usually high-elevation or other cold-site trees) in time for use. The inaccessibility of other trees in years of heavy snowpack has prevented pollen collection.

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To supply this occasional need, as early as 1951 we began using pollens that were stored in a household refrigerator (at 35° to 40° F.). These pollens were unsatisfactory. Although germination counts often showed 80 to 90 percent viability, sound seed set was very low. In this respect, Callaham and Steinhoff[2] have shown that western white pine pollens stored at about 41° F. were incapable of producing sound seed after 2 years of storage.

After 1960 we began to store pollens in a household "deep-freeze" unit, at 0° to 5° F., and thereafter used 1- to 5-year-old stored pollens from this unit in making some 60 intraspecies crosses. In 55 of these crosses--involving 28 trees and four pollination seasons--one or more crosses utilizing fresh pollens were made simultaneously. The 28 different trees were in 11 stands located 2 to 150 miles apart and ranging between 2,950 and 5,100 feet in elevation.

Thus, although truly paired samples (using both stored and fresh pollen of the same pollen parent, on the same mother trees in the same year) or samples using the same stored pollen in successive years were not available, results from these pollinations in a number of trees and seasons are of value for determining general utility of deep-freeze-stored pollens. Summarized results are given in table 1. Determination of statistical significance of differences has not been attempted.

Wide differences in filled-seed yield were associated with pollination years. The 1964 pollinations gave relatively low seed yields, and 1966 pollinations relatively high ones, in both stored- and fresh-pollen crosses.

Within 2 pollination years, where tree, cross, and cone basis was adequate, filled-seed yield in crosses made with 1- to 3-year-old pollens ran 36 to 95 percent of that of fresh-pollen crosses; and on the average, 1- and 2-year-old pollen crosses produced 88 to 110 percent as many sound seed as corresponding fresh-pollen crosses. In a single relatively poor seed year (1964), however, 3-year-old pollens produced only about 50 percent as many filled seed as fresh pollens. Results, in general, agree with those reported for P. monticola by Callaham and Steinhoff (see footnote 2); however, these authors showed that 5-year-old pollens produced seed yields ranging from 25 to 90 percent of those obtained with fresh pollens.

From this we conclude that rather than delay scheduled pollinations, particularly "windup" work in remote areas, it will be safe and greatly advantageous to substitute deep-freeze-stored pollens, up to 3 and possibly 5 or more years old, for fresh pollens.

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[2]Callaham, R. Z., and R. J. Steinhoff. Pine pollens frozen five years produce seed. Pp. 94-101, in Proc. 2nd Forest Genetics Workshop, 1965. U.S. Dep. Agr., Forest Serv. Res. Pap. NC-6, 110 pp. 1966.

Table 1.--Seed yield with stored and fresh pollens

Pollination year	Number of trees pollinated	Stored pollen				Fresh pollen			Seed yield with stored pollen (% of fresh pollen seed yield)
		Pollen age	Crosses made[1]	Cones extracted[2]	Sound seed per cone[3]	Crosses made[1]	Cones extracted[2]	Sound seed per cone[3]	
		Years							
1962	7	1	7	42.5	42.2	9	38	38.5	109.6
1964	5	1	6	67	11.1	7	89	30.9	35.9
	1	2	2	40	8.4	1	14	1.2	[4]700.0
	12	3	14	158	44.2	16	247	85.7	51.6
	2	4	2	10	7.0	2	13	42.5	[4] 16.4
1965	4	1	8	44	70.1	16	127	85.9	81.6
	6	2	6	33	71.1	23	193	75.0	94.8
1966	6	1	8	35	111.7	26	182.5	111.2	100.4
	1	2	1	7	138.0	2	9	122.5	[4]112.6
	1	5	1	4	105.0	5	27	87.0	[4]120.7
All years	22	1	29	188.5	58.8	58	436.5	66.6	88.3
	8	2	9	80	72.5	26	216	66.2	109.5
	12	3	14	158	44.2	16	247	85.7	51.6

[1]Crosses were made using 28 different trees, some crossed in more than 1 pollination year.

[2]Total for all crosses; insect-infested portions of cones not included.

[3]Average weighted by number of cones per cross to neutralize effect of erratic average seed yields in crosses that produced very few cones.

[4]Tree, cross, and cone basis inadequate for meaningful comparison.